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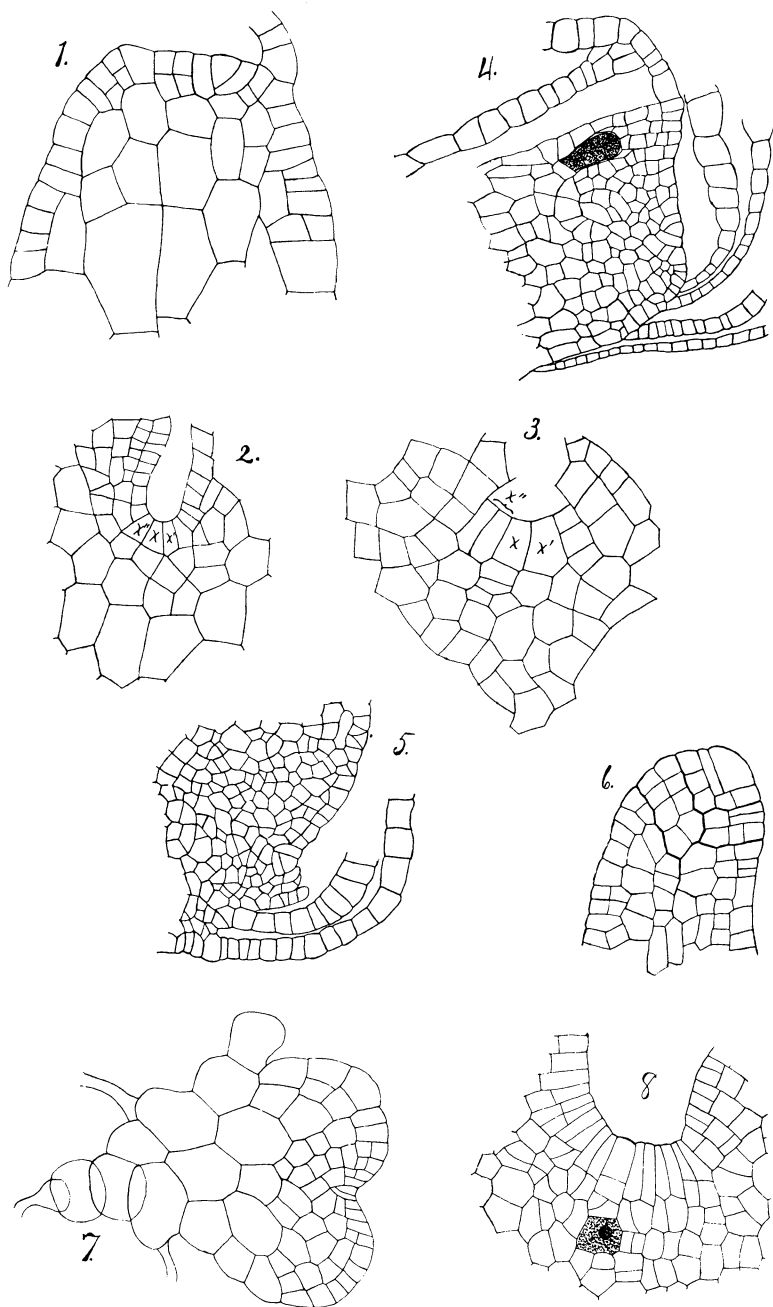
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MOTTIER on APICAL GROWTH OF LIVERWORTS.

On our way home from Jamaica we stopped for three days at Grand Cayman. This is a small coral island midway between Jamaica and the west end of Cuba, and a dependency of the former. The inhabitants are mostly white, very hospitable, and differ from those of the other islands visited in being active, thrifty and enterprising. Here we saw the walnut,<sup>55</sup> whose fruit resembles our black walnut in taste, shape and in being enclosed in a rather woody shuck.

Another interesting tree which we did not see in Jamaica, was the manchioneal.<sup>56</sup> The inhabitants told great stories about its deadly effects and warned me against it. To test the matter I rubbed some of the fresh juice on the back of my hand, allowing it to remain three hours, without result. This only proves that the plant does not always have the effect ascribed to it. But it seems to be a fact, from the common report, that the juice will frequently form bad sores where it touches the skin. As is the case with our poison ivy, it probably depends upon circumstances and the individual.

During the trip I made collections of seeds, living plants and herbarium specimens which are being studied at the Garden. There are many difficulties in the way of collecting dried plants in the tropics. One of the worst is the humidity of the atmosphere. I succeeded in avoiding all trouble from mould by using drying paper (best quality carpet paper) which had been previously impregnated with corrosive sublimate. I used wire presses, with straps, changed the papers at least twice a day, and frequently exposed the already dried bundles to the sun.

*Missouri Botanical Garden, St. Louis.*

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## Notes on the apical growth of Liverworts.

DAVID M. MOTTIER.

(WITH PLATE XIII.)

The striking similarity between the very young thallus of certain liverworts and fern prothallia is a familiar fact to botanists and has led me to suspect that a careful study of the apical growth of several available forms, by more accurate

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<sup>55</sup> *Aleurites triloba*. (Euphorb.)

<sup>56</sup> *Hippomane mancinella* (Euphorb.)

methods than have been heretofore used, might perhaps throw more light upon the affinities of these groups of plants, or add something toward the confirmation of the generally accepted views.

As is well known, the commonly accepted view of botanists is that growth in the thallus in the Marchantiaceæ and allied forms takes place by means of several initial cells.<sup>1</sup> From careful serial microtome sections of young plants grown from gemmæ of *Marchantia polymorpha* it seems very probable that in these young plants there is only one apical cell. In a series of longitudinal vertical sections of a number of young plants only one apical cell was found (fig. 1). Sections made parallel to the surface (longitudinal transverse) of plants of the same size and age, as those just mentioned show two or three cells lying side by side, which have been regarded as initial cells, and may yet be so regarded. Kny (Bau und Entwicklung von *Marchantia polymorpha*, p. 374) says: "At the bottom of the apical indentation, slightly bent toward the under side, there is a row of cells each of which is bounded externally by a free, slightly curved wall and has two side walls converging slightly toward the front and two posterior meeting the latter at right angles and cutting each other at the back (nach rückwärts). [That is, the apical cell is in the shape of a broad wedge]. Although one or two cells necessarily occupy a middle position within the row, we cannot therefore speak positively of two or more apical cells, because it is not possible to demonstrate that a certain one or two cells form the permanent organic middle point from which regular segments are derived. The possibility is not excluded that by further growth in width on one side of the apical region, one cell, at first exactly in the middle, or its axial descendants, may be pushed to one side." Now from sections parallel to the surface of a young plant of *Marchantia polymorpha* (fig. 2) it is difficult to say whether cells  $x$ ,  $x'$ , and  $x''$ , are all apical cells or just one,  $x$ . From the statement of Kny just quoted I am rather inclined to think that one cell,  $x$ , is the true apical cell, and  $x'$  and  $x''$  are segments just cut off in the order indicated. From fig. 3, a similar section of the thallus of *Asterella hemisphærica*, it is seen that very much the same order exists, it being difficult, if not impossible, to decide whether one,  $x$ , is the apical cell and  $x'$  and

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<sup>1</sup> Schenk: Handbuch, vol. 2, p. 331. 1882. Leitgeb: Untersuchungen ueber die Lebermoose, part 6, p. 2. 1879. Also: part 4, p. 16.

$x''$  only segments, or whether all are apical cells. Essentially the same thing occurs in *Conocephalus conicus*, *Anthoceros lævis*, and *Riccia*. Moreover as stated in a foregoing paragraph, only one apical cell has been found in longitudinal vertical sections, as shown in figures 1, 4, 5, and 6. Yet it may be, from the fact that this row of cells is arranged in a curved position on account of the hinder part being wider than the fore-edge, that longitudinal sections would pass only directly through the long axis of one cell, the others being cut more or less obliquely, thus obliterating the appearance of the segments of the apical cell. In older plants this might perhaps be more probable, but in young plants (and this was the kind used) the planes of the longitudinal axes do not seem to diverge enough to obscure the arrangement of the segments.

However this may be as to the number of apical cells, such are the facts observed by me, and from these it seems that it is as probable that there is but one as that there are several.

The resemblance between a fern prothallium and a young thallus of *Marchantia polymorpha* grown from a spore, is indeed very striking, as will be seen upon comparing fig. 7 with a young prothallium. In this (fig. 7) there is but one apical cell whose segments already cut off can be followed without the slightest difficulty. A transverse section through the growing region of a fern prothallium shows a structure similar to that in the liverworts under consideration (fig. 8). Here will be seen one or several initial cells, the number varying with the width of the sinus.

All sections were cut from specimens imbedded in paraffin, by a Minot microtome. The specimens were fixed in chromic acid 1 per cent. or absolute alcohol, stained *in toto* with alum cochineal, and counterstained on the slide with Bismarck brown (70 per cent. alcohol solution). The Bismarck brown is a very satisfactory stain for cell walls.

*Indiana University, Bloomington, Ind., March 5, 1891.*

EXPLANATION OF PLATE XIII.—Fig. 1, longitudinal vertical section of growing point of young thallus of *Marchantia polymorpha*.—Fig. 2, transverse longitudinal section of similar plant.—Fig. 3, transverse longitudinal section through growing point of *Asterella hemisphaerica*.—Fig. 4, longitudinal vertical section of same plant as 3.—Fig. 5, same, of *Conocephalus conicus*.—Fig. 6, same, of *Anthoceros lævis*.—Fig. 7, young thallus of *Marchantia polymorpha* grown from spore (after Kny).—Fig. 8, transverse longitudinal section through the apical region of a prothallium of *Onoclea struthiopteris*; the shaded cell is the egg-cell of an archegonium.

All figures are magnified about 350 diam. except 6 which is about 175 diam. and 7 about 1200 diam.